AMENDMENTS TO THE CLAIMS

Please amend claims 1, 11-12, 14, 16-35, 43-46, 49 and 55-65 as follows.

Please cancel claims 41 and 51-54 without prejudice.

Please add new claims 67-77 as follows.

1. (Currently amended) An ~~optical tuning~~ apparatus, comprising:

a first tunable wavelength selection element configured to define a first plurality of tunable transmission peaks separated by a first adjustable free spectral range, the first plurality of tunable transmission peaks within a gain bandwidth of a gain medium optically couplable to the optical tuning apparatus;

a second tunable wavelength selection element configured to define a second plurality of tunable transmission peaks separated by a second adjustable free spectral range, the second plurality of tunable transmission peaks within the gain bandwidth of the gain medium; and

a controller, operatively coupled to each of the first and second tunable wavelength selection elements, to adjust the first and second free spectral ranges to produce at least one tunable joint transmission peak, wherein each of said at least one tunable joint transmission peak comprises a respective pair of transmission peaks, one from each of the first and second plurality of tunable transmission peaks, that are aligned, and said at least one tunable transmission peak is tuned using a Vernier tuning effect.

2. (Previously presented) The apparatus of claim 1, wherein said at least one joint transmission peak is adjustable according to tuning of said first and second tunable wavelength selection elements.

3-7. (Cancelled)

8. (Original) The apparatus of claim 1, wherein said first and second tunable wavelength selection elements comprise at least one etalon.

9. (Original) The apparatus of claim 1, wherein said first and second tunable wavelength selection elements comprise at least one grating.

10. (Original) The apparatus of claim 1, wherein said first and second tunable wavelength selection elements comprise first and second etalons.

11. (Currently amended) The apparatus of claim 10, wherein at least one of said first and second etalons is ~~thermo-optically tunable~~ a tunable air gap etalon.

12. (Currently amended) The apparatus of claim [[10]] 1, ~~wherein at least one of said first and second etalons is electro-optically tunable.~~ wherein the first and second tunable wavelength selection elements are configured in a birefringent etalon.

13. (Original) The apparatus of claim 10, wherein at least one of said first and second etalons is angle tuned.

14. (Currently amended) The apparatus of claim 10, wherein at least one of said first and second etalons comprises a ~~semiconductor material~~ a wedge-shaped etalon that is positioned via a micro-electro-mechanical systems (MEMS) actuator.

15. (Original) The apparatus of claim 10, wherein at least one of said first and second etalons includes first and second surfaces, each said surface having at least one quarter wave dielectric pair layer thereon.

16. (Currently amended) The apparatus of claim [[14]] 1, ~~wherein said etalon includes a thermal control element integrated thereon.~~ further comprising a beam splitter positioned in a light beam generated by the gain medium, the beam splitter positioned before the first and second tunable wavelength selection elements, the beam splitter to pass a first light beam to the first tunable wavelength selection element and to pass a second light beam to the second tunable wavelength selection element.

17. (Currently amended) The apparatus of claim [[11]] 10, wherein said controller comprises a thermal controller, wherein the first and second etalons are thermo-optically tunable.

18. (Currently amended) The apparatus of claim [[11]] 1, ~~wherein said etalon is operatively coupled to a thermal reservoir.~~ wherein a rear facet of the gain medium and a reflector optically couplable to the gain medium define an external laser cavity of the apparatus, wherein the external laser cavity serves as the second tunable wavelength selection element.

19. (Currently amended) A laser apparatus, comprising

a base;

a gain medium, operatively coupled to the base, to emit a light beam in response to an electric input;

a first tunable wavelength selection element operatively coupled to the base and positioned in the light beam, configured to define a first plurality of tunable transmission peaks having a first adjustable free spectral range, the first plurality of tunable transmission peaks within a gain bandwidth of the gain medium;

a second tunable wavelength selection element operatively coupled to the base and positioned in ~~said~~ the light beam, configured to define a second plurality of tunable transmission peaks having a second adjustable free spectral range, the second plurality of tunable transmission peaks within the gain bandwidth of the gain medium; and

a controller, operatively coupled to each of the first and second tunable wavelength selection elements, to tune a wavelength of an optical output produced by the laser apparatus by concurrently adjusting the first and second free spectral ranges of the first and second tunable wavelength selection elements to define a single joint transmission peak within a selectable wavelength range and adjustable in phase according to tuning of said first and second tunable wavelength ~~selections~~ selection elements.

20. (Currently amended) The laser apparatus of claim 19, wherein the gain medium comprises a laser diode having first and second facets defining an internal cavity having a free spectral range and emitting the light beam from the first facet.

21. (Currently amended) The laser apparatus of claim 20, further comprising a reflective element positioned in said light beam after the first and second tunable wavelength selection elements, the reflective element and the second facet of the gain medium defining an external cavity ~~laser~~.

22. (Currently amended) The laser apparatus of claim 20, wherein the first tunable wavelength selection element has a first free spectral range that is approximately equal to a multiple of the free spectral range of the gain medium.

23. (Currently amended) The laser apparatus of claim 20, wherein the second tunable wavelength selection element has a second free spectral range that is approximately equal to a multiple of the free spectral range of the gain medium.

24. (Currently amended) The laser apparatus of claim 20, wherein the selectable wavelength range is at least as great as a gain bandwidth of said gain medium.

25. (Currently amended) The laser apparatus of claim 19, wherein said first and second tunable wavelength selection elements comprise at least one etalon.

26. (Currently amended) The laser apparatus of claim 19, wherein said first and second tunable wavelength selection elements comprise at least one grating.

27. (Currently amended) The laser apparatus of claim 19, wherein said first and second tunable wavelength selection elements comprise first and second tunable etalons.

28. (Currently amended) The laser apparatus of claim 27, wherein at least one of said first and second tunable etalons is thermo-optically tunable.

29. (Currently amended) The laser apparatus of claim 27, wherein at least one of said first and second tunable etalons is electro-optically tunable.

30. (Currently amended) The laser apparatus of claim 27, wherein at least one of said first and second tunable etalons is angle tuned.

31. (Currently amended) The laser apparatus of claim 27, wherein at least one of said tunable etalons comprises a semiconductor material.

32. (Currently amended) The laser apparatus of claim 27, wherein at least one of said tunable etalons includes first and second surfaces, each said surface having at least one quarter wave dielectric pair layer thereon.

33. (Currently amended) The laser apparatus of claim 31, wherein said tunable etalon includes a thermal control element integrated thereon.

34. (Currently amended) The laser apparatus of claim 28, wherein said tunable etalon is operatively coupled to a thermal controller.

35. (Currently ameded) The laser apparatus of claim 28, wherein said tunable etalon is operatively coupled to a thermal reservoir.

36-39. (Cancelled)

40. (Previously presented) A method for tuning a light beam, comprising:

positioning a first tunable wavelength selection element in the light beam generated by a gain medium, the first tunable wavelength selection element configured to define a first plurality of tunable transmission peaks having a first adjustable free spectral range, the first plurality of tunable transmission peaks within a gain bandwidth of the gain medium;

positioning a second tunable wavelength selection element in the light beam, the second tunable wavelength selection element configured to define a second plurality of tunable transmission peaks having a second adjustable free spectral range, the second plurality of tunable transmission peaks within the gain bandwidth of the gain medium; and

concurrently tuning the first and second tunable wavelength selection elements to align one of the first plurality of transmission peaks with one of the second plurality of transmission peaks via a Vernier tuning effect to define a single joint transmission peak.

41. (Cancelled)

42. (Cancelled)

43. (Currently amended) The method of claim 40, further comprising:

~~providing a gain medium having first and second facets;~~

emitting the light beam from ~~the~~ a first facet of the gain medium; and

positioning a reflective element in the light beam after the first and second tunable wavelength selection elements, the reflective element and ~~the~~ a second facet of the gain medium defining an external laser cavity.

~~44.~~ (Currently amended) The method of claim 43, wherein ~~the first and second tunable wavelength selection elements are tuned to define a plurality of joint transmission peaks having a joint free spectral range that is at least as great as a gain bandwidth of the gain medium.~~ the second tunable wavelength selection element is defined by the external laser cavity.

45. (Previously presented) The method of claim [[43]] 40, ~~wherein the first free spectral range is approximately equal to a multiple of a free spectral range of the gain medium.~~ further comprising splitting the light beam into a first light beam to pass through the first tunable wavelength selection element and into a second light beam to pass through the second tunable wavelength selection element.

46. (Currently amended) The method of claim [[45]] 40, ~~wherein the second free spectral range is approximately equal to a multiple of the gain medium free spectral range.~~ further comprising positioning a third tunable wavelength selection element in the light beam defining a third plurality of tunable transmission peaks to provide a triple Vernier tuning effect to define the single joint transmission peak.

47. (Previously presented) The method of claim 40, wherein:

positioning the first tunable wavelength selection element comprises positioning a first tunable etalon in the light beam; and

positioning the second tunable wavelength selection element comprises positioning a second tunable etalon in the light beam.

48. (Previously presented) The method of claim 47, wherein concurrently tuning the first and second tunable wavelength selection elements comprises thermo-optically tuning the first and second tunable etalons.

49. (Currently amended) The method of claim 48, wherein said thermo-optically tuning comprises[[;]]:

thermally adjusting a refractive index of the first tunable etalon; and

thermally adjusting a refractive index of the second tunable etalon.

50. (Previously presented) The method of claim 49, wherein said thermo-optically tuning further comprises:

thermally adjusting a physical thickness of the first tunable etalon; and

thermally adjusting a physical thickness of the second tunable etalon.

51. (Cancelled)

52. (Cancelled)

53. (Cancelled)

54. (Cancelled)

55. (Currently amended) The ~~optical tuning~~ apparatus of claim 1, further comprising a third tunable wavelength selection element to provide a triple Vernier tuning effect. ~~configured to define a tunable pass band.~~

56. (Currently amended) The ~~optical tuning~~ apparatus of claim 1, wherein the first adjustable free spectral range (FSR_1) is related to the second adjustable free spectral range (FSR_2) by the equation:

$$\text{~~FSR}_1 \approx (M/M+N)(FSR_2)\text{~~} \quad \text{FSR}_1 \approx (M/M \pm N)(FSR_2)$$

wherein M is the total number of tunable wavelengths within a selected wavelength range, and N is a non-integer or integer number that is selectable.

57. (Currently amended) The ~~optical tuning~~ apparatus of claim 1, wherein each of the first and second adjustable free spectral ranges are greater ~~that~~ than a wavelength channel spacing in a communication grid to which the apparatus may be tuned.

58. (Currently amended) The ~~optical tuning~~ apparatus of claim 1, wherein the apparatus enables continuous, selective wavelength tuning over a wide wavelength range in a manner that is independent of a fixed, pre-determined wavelength grid.

59. (Currently amended) The laser apparatus of claim 19, further comprising a third tunable wavelength selection element operatively coupled to the base and positioned in the light beam to provide a triple Vernier tuning effect. ~~, configured to define a tunable pass band~~.

60. (Currently amended) The laser apparatus of claim 19, wherein the first adjustable free spectral range (FSR_1) is related to the second adjustable free spectral range (FSR_2) by the equation:

$$\text{~~FSR}_1 \approx (M/M+N)(FSR_2)\text{~~} \quad FSR_1 \approx (M/M \pm N)(FSR_2)$$

wherein M is the total number of tunable wavelengths within a selected wavelength range, and N is a non-integer or integer number that is selectable.

61. (Currently amended) The laser apparatus of claim 19, wherein each of the first and second adjustable free spectral ranges are greater ~~that~~ than a wavelength channel spacing in a communication grid to which the laser apparatus may be tuned.

62. (Currently amended) The laser apparatus of claim [[1]] 19, wherein the apparatus enables continuous, selective wavelength tuning over a wide wavelength range in a manner that is independent of a fixed, pre-determined wavelength grid.

63. (Currently amended) A laser apparatus, comprising

a base;

~~an end~~ a reflector, operatively coupled to the base;

a gain medium, operatively coupled to the base, having a first facet from which a light beam is emitted in response to an electric input and a second facet opposite the first facet, the second facet and the reflector defining an external laser cavity having a first adjustable free spectral range and providing a plurality of lasing modes having a first plurality of transmission peaks within a gain bandwidth of the gain medium; and

a tunable wavelength selection element operatively coupled to the base and positioned between the first facet and the reflector, configured to define a second plurality of tunable transmission peaks having a second adjustable free spectral range, the second plurality of tunable transmission peaks within the gain bandwidth of the gain medium,

wherein the first adjustable free spectral range is related to the second adjustable free spectral range such that the first and second plurality of transmission peaks may be adjusted to generate a tunable joint transmission peak via a Vernier tuning effect.

64. (Currently amended) The laser apparatus of claim [[64]] 63, wherein the tunable wavelength selection element comprises an etalon.

65. (Currently amended) The laser apparatus of claim [[64]] 63, wherein the first adjustable free spectral range (FSR_1) is related to the second adjustable free spectral range (FSR_2) by the equation:

~~$FSR_1 \approx (M/M+N)(FSR_2)$~~ $FSR_1 \approx (M/M \pm N)(FSR_2)$

wherein ~~K is a rational fraction,~~ M is the total number of tunable wavelengths within a selected wavelength range, and N is a non-integer or integer number that is selectable.

66. (Previously presented) The laser apparatus of claim [[64]] 63, wherein the tunable wavelength selection element comprises a wedge-shaped etalon that is positioned via a micro-electro-mechanical systems (MEMS) actuator.

67. (New) The laser apparatus of claim 19 wherein the second tunable wavelength selection element comprises a wedge-shaped etalon, the wedge-shaped etalon coupled to hinge elements and to electrode elements to position the wedge-shaped etalon in the light beam.

68. (New) The laser apparatus of claim 19, further comprising a beam splitter positioned in the light beam before the first and second tunable wavelength selection elements, the beam splitter to pass a first light beam to the first tunable wavelength selection element and to pass a second light beam to the second tunable wavelength selection element.

69. (New) The laser apparatus of claim 19 wherein at least one of the first and second tunable wavelength selection elements comprises a tunable air gap etalon.

70. (New) The laser apparatus of claim 69 wherein the tunable air gap etalon to provide feedback to the gain medium for wavelength selection.

71. (New) The laser apparatus of claim 19 wherein the first and second tunable wavelength selection elements are included in a birefringent etalon.

72. (New) The laser apparatus of claim 21 wherein the external cavity serves as the second tunable wavelength selection element.

73. (New) A laser apparatus, comprising:

a reflector;

a gain medium including a first facet from which a light beam is emitted in response to an electric input and a second facet opposite the first facet, the second facet and the reflector defining an external laser cavity;

a first tunable wavelength selection element positioned between the first facet and the reflector, configured to define a first plurality of tunable transmission peaks having a first adjustable free spectral range, the first plurality of tunable transmission peaks within the gain bandwidth of the gain medium,

a second tunable wavelength selection element positioned between the first tunable wavelength selection element and the reflector, configured to define a second plurality of tunable transmission peaks having a second adjustable free spectral range, the second plurality of tunable transmission peaks within the gain bandwidth of the gain medium; and

a third tunable wavelength selection element positioned between the second tunable wavelength selection element and the reflector, configured to define a third plurality of tunable transmission peaks having a third adjustable free spectral range, the third plurality of tunable transmission peaks within the gain bandwidth of the gain medium,

wherein the first, second and third plurality of transmission peaks may be adjusted to generate a tunable joint transmission peak via a triple Vernier tuning effect.

74. (New) The laser apparatus of claim 73 wherein the second wavelength selection element comprises an etalon.

75. (New) The laser apparatus of claim 73 wherein the second wavelength selection element comprises a wedge-shaped etalon that is positioned via a micro-electro-mechanical systems (MEMS) actuator.

76. (New) The laser apparatus of claim 73 wherein the third wavelength selection element comprises an etalon.

77. (New) The laser apparatus of claim 73 wherein the third wavelength selection element comprises an electro-optic material with a voltage-dependent index of refraction.